UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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March 28, 2008

Mr. Jim McKenna
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121 NW Everett
Portland, Oregon 97209

Mr. Robert Wyatt
Northwest Natural & Co-Chairman, Lower Willamette Group
220 Northwest Second Avenue
Portland, Oregon 97209

Re: Portland Harbor Superfund Site; Administrative Order on Consent for Remedial Investigation and Feasibility Study; Docket No. CERCLA-10-2001-0240. EPA Guidance on the Portland Harbor Feasibility Study

Dear Messrs. Wyatt and McKenna:

The Portland Harbor Remedial Investigation and Feasibility Study (RI/FS) is beginning to transition from the RI phase into the FS phase. The FS has been identified as a critical element for maintaining the current project schedule. In addition, given the geographical extent of the Portland Harbor project and the large number of potential sources of contamination, developing the FS for the Portland Harbor site is expected to be technically and logistically complex endeavor. As a result, EPA has developed the attached guidance to facilitate the development of the Portland Harbor FS. These comments should be considered in conjunction with recent EPA comments on the Round 2 Report and the Treatability Study Literature Review.

The attached guidance should serve as the basis for reaching agreement on the format of the Portland Harbor FS and ensuring that the overall RI/FS remains on schedule. We look forward to discussing the format of the Portland Harbor FS further with you and your technical representatives. If you have any questions, please contact Chip Humphrey at (503) 326-2678 or Eric Blischke (503) 326-4006. All legal inquiries should be directed to Lori Cora at (206) 553-1115.

Sincerely,

Chip Humphrey
Eric Blischke
Remedial Project Managers

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EPA Guidance on the Portland Harbor Feasibility Study
March 28, 2008

Introduction:

Purpose:

The Portland Harbor Programmatic RI/FS Work Plan, Appendix A: Feasibility Study Work Plan (FS Work Plan) describes the general approach and tasks to be performed to develop the recommended remedy for the Portland Harbor Superfund Site. Significant progress has been made since the FS Work Plan was developed which has advanced our understanding of the Site and the need to further refine work elements and the path forward for the feasibility study (FS). The purpose of this guidance is to provide a framework for additional discussion with the Lower Willamette Group (LWG) with the goal of refining and supplementing the Work Plan approach to ensure the timely completion of a comprehensive Feasibility Study for the Site.

At this time, data collection activities in support of the Portland Harbor remedial investigation (RI) and baseline risk assessments (BRA) are generally complete. The draft RI Report is expected by the end of 2008. A draft FS Report is expected mid- to late-2009. EPA has developed the attached guidance to facilitate the development of the Portland Harbor FS. This guidance should serve as the basis for reaching agreement on the format of the Portland Harbor FS and ensuring that the overall RI/FS remains on schedule. This guidance should be considered in conjunction with EPA's recent comments on the draft Treatability Study Literature Survey Technical Memorandum (February 15, 2008), general comments on the Round 2 Report (January 15, 2008), EPA's Problem Formulation for the Ecological Risk Assessment (February 15, 2008) and EPA's comments on Preliminary Remediation Goals (PRGs) as presented in Section 10 of the Round 2 Report (March 20, 2008).

The Programmatic Work Plan identifies two preliminary FS documents – the Refined Preliminary Remedial Action Objectives Technical Memorandum (RAO TM) and the Alternatives Development and Screening Report. The RAO TM (or alternate vehicle) should be used to document preliminary RAOs and PRGs to be used in the FS. The Alternatives Development and Screening Report may be used to present the screening of remedial action alternatives as described in this guidance.

Considerations for the Portland Harbor Feasibility Study:

EPA expects that a combination remedy that involves dredging and the subsequent disposal and placement options, capping and monitored natural recovery will be the primary risk reduction strategy throughout the Portland Harbor Site. In addition, EPA expects that due to the large area and volume of material that may require remediation at Portland Harbor, hybridization of sediment remediation and treatment options and integration into long-term regional sediment management actions may prove cost effective at the Portland Harbor Site, especially if treatment costs can be off-set by beneficial re-use of treated sediment. This comprehensive combination remedy should provide a coherent strategy for identifying and optimizing cleanup activities throughout Portland Harbor which may need to be implemented over several years. The

development and optimization of remedial options is expected to occur using a series of iterative alternative screening steps. The example FS Process Outline provided as Figure 1 represents EPA's preliminary vision of how the process might be structured and is provided to elicit discussion. The screening and optimization steps would be for the purpose of initially refining as yet unidentified Areas of Potential Concern (AOPC) into logical Sediment Management Areas (SMA), and developing a suite of detailed remedy alternatives that would be carried through the detailed evaluation of alternatives against the National Contingency Plan (NCP) remedy selection criteria. EPA expects that the detailed evaluation of remedial action alternatives will/could be based on different combinations of dredging-, capping-, and monitored natural recovery (MNR)-emphasis remedies based on consideration of the characteristics and opportunities available harbor-wide or at individual SMAs. It is timely to begin to develop this screening structure, its elements, and implications now.

Many elements that must be evaluated to implement a protective remedy at the Portland Harbor site will require design-level information to fully assess the potential effectiveness of the risk reduction measures. Once sediment management areas and PRGs are defined, sediment management areas may be grouped to facilitate assessment during the detailed evaluation of remedial action alternatives in the Feasibility Study or subsequently in Remedial Design.

EPA has identified key issues for the Portland Harbor FS which require thorough discussions with the LWG. These issues may generally be classified as technical or logistical. All represent site-wide challenges that could impede development of a feasible and implementable remedy while at the same time providing opportunities for inclusion of "adaptive management" components. Key technical and logistical issues are outlined below as a starting point for further discussion:

Technical Issues:

1) Source Control. The control of sources of contamination to Portland Harbor will be key to the ultimate success of the contaminated sediment remedy. Under EPA guidance, source control should be achieved prior to the implementation of a sediment remedy. At this time it is unclear how source control will be addressed in the Portland Harbor FS. The status and effectiveness of source control will likely need to be factored into the effectiveness evaluation. For source control measures that have not been implemented or completed, a schedule for source control will need to be considered. EPA believes that long-term efforts to control contaminant discharges within Portland Harbor and the Willamette River watershed as a whole will be required to achieve a protective remedy for the Portland Harbor site. The scope, nature, timing, and measurements of success for this element and how they will affect the conduct of individual contaminated sediment areas and overall Portland Harbor remedy presently lacks definition.

2) Aquatic Habitat Function. Contaminated sediments within Portland Harbor must be remediated in a manner that, to the maximum extent practicable, is consistent with and supportive of aquatic ecosystem enhancement/restoration and the conservation and recovery of ESA listed species. Habitat re-establishment in areas where remediation substantially affects the exiting habitat (mitigation) must be considered during the evaluation of remedial action alternatives. Restoration activities may also be required to comply with action specific ARARs

(e.g., CWA 404 and ESA). Furthermore, the natural resource damage assessment (NRDA) process and other ongoing ecosystem restoration efforts may result in the implementation of restoration projects within Portland Harbor. Consideration of potential restoration projects in conjunction with or subsequent to implementation of cleanup activities should be considered in the Portland Harbor FS. Habitat re-establishment and habitat restoration as a function of compliance with ARARs should be integrated into the FS on an SMA by SMA basis.

3) Disposal. The Portland Harbor FS will identify disposal options for the Portland Harbor. The disposal site evaluation should build off the information presented in the draft Disposal Site Inventory Preliminary Screening Report. The evaluation of disposal sites ultimately will need to consider: Upland disposal, confined aquatic disposal (in-water disposal sites), near shore confined disposal facilities (CDFs), the need for and requirements to site rehandling facilities, beneficial reuse, pre-treatment (including dewatering and treatment necessary to meet any land disposal restrictions). At minimum, the FS evaluation should consider the availability of potential sites, the capacity of potential disposal sites, whether sites are available now or must be constructed, method of transport and distance to facility, and regulatory implications.

4) Consideration of Background: EPA acknowledges that PRGs for some chemicals and pathways may be below natural and/or anthropogenic background concentrations. As described our comments on the Section 10 of the Round 2 Report, estimated PRGs should be compared to background levels to determine whether it is feasible to achieve risk-based sediment and water cleanup levels in Portland Harbor. As a hypothetical example, if the risk-based sediment PCB PRG for a 142 g/day fish consumption scenario is 0.050 ug/kg and the background PCB concentration is 4 ug/kg, both pieces of information should be presented and carried forward into the feasibility study recognizing that it may be technically infeasible to cleanup contamination to concentrations below background on a site-wide basis.

Logistical Issues:

1) Presentation of information in the FS: Given the size of the Portland Harbor Site, the number of specific sources, the dynamic nature of the river and watershed considerations, the Portland Harbor FS will be necessarily complex. EPA believes that some streamlining of the FS Report will be necessary to keep it manageable. Discussion is needed on how to organize the required evaluations and documents. The LWG has indicated that they will provide some potential example templates.

2) "Adaptive Management" Tools: Given the uncertainty surrounding some key elements of the human health and ecological risk assessments, the contribution of watershed-wide contaminants and the need for effective source control to ensure a protective remedy, how can "adaptive management" be integrated meaningfully into the design of any combination remedy? Would measurements of success for an "adaptive management" element be area specific or site-wide? EPA believes that ROD amendments, Explanation of Significant Differences (ESDs) and Five-Year ROD Reviews are all effective tools for modifying remedies as necessary to achieve long-term protectiveness. At this time it is not clear that the LWG and EPA have a mutual understanding of these terms and concepts.

3) Sequencing of In-Water Activities: Remediating contaminated sediments in a flowing river with fish windows that limit the duration of in-water remedial activities has significant implications for how sediment cleanups will be implemented within Portland Harbor. Sediment cleanup activities will need to be staged in a manner that minimizes the potential for recontamination of areas that have already been remediated. This element will need to be considered in the detailed evaluation of remedial action alternatives.

Feasibility Study Process:

EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites Guidance for Contaminated Sediment Sites (December 2005) and RI/FS Guidance (October 1988) provide direction on the development and screening of remedial action alternatives. The following steps should be considered when developing remedial action alternatives for sediment sites:

1. Develop remedial action objectives specifying the contaminants and media of interest, exposure pathways, and remediation goals that permit a range of alternatives to be developed including each of the three major approaches (MNR, capping, and removal), and that consider state and local objectives for the site;
2. Identify estimated volumes or areas of sediment to which the approaches may be applied, taking into account the need for protectiveness as identified in the RAOs and the biological, chemical and physical characteristics of the site;
3. Develop additional detail concerning the equipment, methods, and locations to be evaluated for each alternative, including the three major approaches (e.g., potential natural recovery processes, potential cap materials and placement methods, number and types of dredges or excavators, transport methods, treatment methods, type of disposal units, general disposal location, need for monitoring and/or institutional controls);
4. Develop additional detail concerning known major constraints on each alternative, including the three major approaches at the site (e.g., need to maintain flow capacity for flood control, need to accommodate navigational dredging);
5. To the extent possible with information available at this stage of the FS, identify the time frame(s) in which the alternatives are expected to achieve cleanup levels and RAOs; and
6. Assemble the more detailed methods into a set of alternatives representing a range of options, including MNR, in-situ capping, and removal options or combination of options, as appropriate.

The following sections are intended to provide site-wide understandings of definition of terms, of important steps in the FS process, and general information from existing EPA guidance and status of efforts to date in the Portland Harbor site. Each will need to be specifically addressed in the FS report.

Remedial Action Objectives:

Remedial action objectives (RAOs) are intended to provide a general description of what the cleanup is expected to accomplish, and help focus the development of the remedial alternatives

in the feasibility study. RAOs are typically derived from the conceptual site model and address the significant exposure pathways. RAOs may vary widely for different parts of the site based on the exposure pathways and receptors. Preliminary RAOs were established in the Programmatic Work Plan for the Portland Harbor RI/FS (Work Plan - April 2004):

1. Reduce human health risks from direct contact with and incidental ingestion of chemicals of concern (COCs) in sediment in the site to acceptable levels.
2. Reduce COC concentrations in sediments in the Site to levels that will result in acceptable risks to humans that eat fish and shellfish from the Site.
3. Reduce human health risks from direct contact with and incidental ingestion of COCs in water at the site to acceptable levels.
4. Reduce ecological risks from contact with and ingestion of COCs in sediments or prey in the site to acceptable levels.
5. Reduce ecological risks from contact with and ingestion of COCs in water in the Site to acceptable levels.

Baseline Risk Assessment:

The baseline human health and ecological risk assessments serve as the basis for developing PRGs. Human Health and Ecological Risk Assessment work plans were included in the Portland Harbor RI/FS Work Plan. Key elements of the risk assessment work plans were refined through a series of technical memoranda.

A preliminary assessment of risk was presented in the Comprehensive Round 2 Site Characterization and Summary and Data Gaps Identification Report (Round 2 Report). In general, the human health risk evaluation was performed as agreed upon. Regarding the ecological risk assessment, not all details were resolved prior to submittal of the Round 2 Report. EPA has provided direction on the baseline ecological risk assessment in our February 15, 2008 Problem Formulation for the ecological risk assessment. EPA expects that agreement on the human health and ecological risk assessments will occur prior to June 1, 2008.

Preliminary Remediation Goals:

Typically, preliminary PRGs that are protective of human health and the environment are developed early in the remedial investigation process based on readily available screening levels for both human health and ecological risks. However, for the Portland Harbor site, PRGs were not developed at the work plan stage. Rather, initial preliminary remediation goals (iPRGs) were identified in the Round 2 Report for the Portland Harbor site. EPA provided comments on developing PRGs and areas of potential concern (AOPCs) in our letter dated March 20, 2008. As stated in our comments, PRGs should be developed based on the results of the baseline human health and ecological risk assessments and used to develop AOPCs. EPA acknowledges that procedures for developing PRGs must be resolved during the summer of 2008 in order to have a draft FS submitted by mid-2009. A number of issues associated with PRG development remain to be worked out including how PRGs will be refined into remedial action goals and performance standards. How the issues are resolved will be a major opportunity for incorporating adaptive management elements into the FS process.

Development of General Response Actions:

General response actions were developed in the April 2004 Programmatic Work Plan. GRA's developed in the work plan include institutional controls, natural attenuation (i.e., monitored natural recovery), in-situ-containment (i.e., capping), in-situ treatment, removal (i.e., dredging) and disposal and removal and treatment. For the Portland Harbor site, a combination remedy incorporating various degrees of dredging, capping and MNR is expected to be implemented across the entire site and on a SMA basis. Once SMAs have been developed, a more detailed screen of the remedial technologies will be performed to determine the applicability of specific technologies on a SMA basis considering site specific factors.

Identification of Volumes or Areas of Media:

Initial areas of potential concern (iAOPCs) were presented in the Round 2 Report for the stated purpose of identifying data gaps. EPA expects that AOPCs will be developed based on the results of the baseline human health and ecological risk assessment, PRGs, the application of various modeling results, the spatial distribution of contamination and the application of geo-statistical tools. These AOPCs will be presented in the Alternatives Development and Screening Report, and further refined into sediment management areas (SMAs) for evaluation in the Portland Harbor FS.

SMA Identification:

In order to develop a feasibility study for the Portland Harbor site, AOPCs must be grouped into sediment management areas for evaluation in the feasibility study. SMAs should be identified based on physical parameters, chemical parameters, geographic proximity, release mechanism and site specific factors such as current and potential future site use (see Figure 1). The goal of the SMA identification is to identify areas of contamination that may logically be combined for the purpose of developing, screening and evaluating remedial action alternatives across the site.

Initial Screening of Remedial Technologies:

An initial technology screen should be performed for the Portland Harbor site. This technology screen should build off the information developed in the treatability study literature review technical memorandum, including EPA's comments. In addition, the technology screen should consider standard technologies for addressing contaminated sediments such as dredging and capping technologies. The goal of the initial screening is to gather general information on the cost, effectiveness and permanence and implementability of remediation technologies potentially applicable to the site. The goal is to develop a menu of technology options that can be applied on a SMA basis.

Development and Screening of Remedial Action Alternatives:

Due to the potential number of SMAs likely to be identified for evaluation in the Portland Harbor FS, a rigorous screening of SMA specific remedial action options will be required prior to the

detailed evaluation of a suite of remedy alternatives on a site-wide basis. SMA specific factors should be considered during this step. Factors are identified in Section 5 of the FS Process Outline included as Figure 1 and include physical factors such as grain size, water depth, current velocities and the potential for deposition and/or scour; chemical factors such as toxicity, mobility, and bioavailability; and site specific factors such as release mechanism, current and future land use, navigation requirements and habitat potential.

For each SMA, the results of the technology screen should be applied to each SMA to develop a range of protective options to be carried forward into the identification and detailed evaluation of site-wide remedy alternatives. For alternatives that incorporate dredging elements, a range of treatment and disposal options should be considered. For alternatives that incorporate capping elements, a range of capping options should be considered including reactive caps or other cap amendments.

Detailed Evaluation of Remedial Action Alternatives:

A set of alternatives should be assembled for the detailed evaluation of remedial action alternatives based on the results of the alternative screening step. For each SMA, a range of alternatives should be identified and ordered from least aggressive to most aggressive. For example, for a given SMA, a MNR emphasis, capping emphasis, and dredging emphasis remedy may be developed. Sub-alternatives involving various capping designs and treatment and disposal options for dredged materials should be included when appropriate. This step should be performed for each SMA to develop a range of site-wide alternatives that are evaluated in the detailed evaluation of remedial action alternatives.

The range of site-wide remedy alternatives should be evaluated based on an individual and comparative analysis against the seven evaluation criteria. Modeling results as appropriate should be included in this evaluation (e.g., the hybrid model may be used to evaluate long-term effectiveness; elutriate models may be used to evaluate short-term effectiveness).

The evaluation of remedy alternatives should be designed such that EPA may pick from a menu of SMA-specific alternatives for the purpose of developing a preferred site-wide alternative. EPA may propose more aggressive approaches in SMAs where uncertainty about remedy effectiveness and/or the risk of remedy failure is high. However, given the overall uncertainty surrounding sediment sites, long-term monitoring and five-year reviews will be used by EPA to determine whether the remedy is performing as expected and determining whether any additional sediment remediation and/or source control measures are required.

Next Steps.

The LWG should begin development of the refined RAO technical memorandum. The RAO TM should present the refined RAOs and development of PRGs. PRGs should be based on the baseline risk assessment procedures and the application of various models such as the Portland Harbor Food Web Model and identification of ARARs as described in EPA's comments on Section 10 of the Round 2 Report. The refined RAO TM should be submitted within 90 days following agreement on baseline risk assessment approach and PRG development

(approximately September 1, 2008). AOPCs based on these PRGs should be presented in the Alternative Screening TM and submitted within 90 days following receipt of EPA comments on the RAO TM (approximately February 1, 2009). EPA's goal still remains to have a draft FS submitted during the summer of 2009. Achieving this goal will require close coordination between EPA and LWG representatives.

Figure 1: FS Process Outline

1) Develop RAOs (Section 4.2.1 of RI/FS Guidance)
    a. Refine RAOs based on preliminary RAOs presented in Programmatic Work Plan
    b. Develop and refine PRGs
        i. Baseline risk assessment
        ii. Chemical specific ARARs
        iii. Identify range of PRGs to carry forward into FS

2) Develop General Response Actions (Section 4.2.2 of RI/FS Guidance)
    a. Dredging
    b. Capping
    c. MNR
    d. Treatment
    e. Disposal

3) Identify AOPCs (Section 4.2.3 of RI/FS Guidance)
    a. Horizontal and vertical distribution of contamination and magnitude of risk
    b. Exposure areas for various receptors
    c. Application of Geo-statistical tools (e.g., Thiessen polygons, inverse distance weighting, krieging, risk contouring)
    d. Evaluation of subsurface contamination (e.g., erosion potential)

4) Develop Sediment Management Areas:
    a. Identify area requiring active remediation through "hilltopping" or similar techniques
    b. Develop remediation goals (RGs) for each SMA focusing on key risk drivers
    c. Group according to geographic proximity and SMA specific characteristics
        i. Physical Parameters
            1. Sediment characteristics
            2. Potential for deposition and/or scour
            3. Presence of debris
            4. River depth
            5. Current velocities
            6. Proximity to navigation channel
            7. Level of activity (e.g., shipping activity)
        ii. Chemical Parameters
            1. Risk drivers
            2. Leachability
            3. Organic carbon content
            4. Bioavailability
            5. Presence of NAPL and/or dissolved phase contaminants
        iii. Site Factors:
            1. Release mechanism (e.g., overwater release, upland NAPL release, stormwater discharge, bank erosion)
            2. Geographic location (where does it make sense to group SMAs based on geographic proximity?)

3. Current site use
4. Presence of docks and other in-water structures (e.g., pilings)
5. Potential for future dredging activities
6. Habitat potential
7. Navigation requirements
8. Future site use and development potential

5) Initial Technology Screen – Site-wide (Section 4.2.4 of RI/FS Guidance)
    a. Technology Types and Technology Process Options
        i. Dredging (hydraulic, clamshell, environmental bucket
        ii. Capping (amendments, armoring, thin layer, habitat enhancements)
        iii. Containment (sheet pile, silt curtains, bubble curtains)
        iv. Disposal (CDF, CAD, upland, offsite)
        v. Treatment (in-situ, ex-situ, dewatering, beneficial re-use of material)
        vi. Monitored natural recovery (degradation, dilution)
    b. Evaluation
        i. Effectiveness (chemicals, site specific factors)
        ii. Cost (range for each)
        iii. Implementability (equipment and capping material availability; availability of disposal sites)

6) Development and Screening of Alternatives on SMA Basis:
    a. Apply results of technology screen on SMA basis
    b. Consider SMA specific physical, chemical and site specific factors
    c. For each SMA, develop a range of protective alternatives for screening against effectiveness, implementability and cost
    d. Examples:
        i. Dredging emphasis:
            1. Identify SMAs where dredging is likely to be the primary remediation technology
            2. Estimate the areal and vertical extent of dredging based on application of site-wide technology screen and SMA specific factors
            3. Evaluate the feasibility of various treatment options for dredged material based on application of site-wide technology screen and SMA specific factors
            4. Evaluate the feasibility of various disposal options for dredged material based on application of site-wide technology screen and SMA specific factors
            5. Determine whether post dredging cap placement is required and nature of post dredging cap
            6. Identify areas outside dredge area subject to capping and MNR
            7. Evaluate effectiveness of capping and MNR based on consideration of factors identified below
            8. Evaluate effectiveness of overall SMA remedy at reducing risk through residual risk assessment including time-frame for reducing risk

9. Evaluate need for institutional controls

ii. Capping emphasis
    1. Identify SMAs where capping is likely to be the primary remediation technology
    2. Determine the areal extent of capping based on application of site-wide technology screen and SMA specific factors
    3. Determine whether dredging is required prior to cap placement based on application of technology screen and SMA specific factors
    4. Identify key cap parameters (e.g., thickness, cap type, need for cap amendments) based on application of site-wide technology screen and SMA specific factors
    5. Identify Areas outside cap area subject to MNR
    6. Evaluate effectiveness of MNR based on consideration of factors identified below
    7. Evaluate effectiveness of overall SMA remedy at reducing risk through residual risk assessment including time-frame for reducing risk
    8. Evaluate need for institutional controls

iii. MNR emphasis
    1. Identify SMAs where MNR is likely to be the primary remediation technology
    2. Determine whether source reduction through capping and/or dredging is required based on application of site-wide technology screen and SMA specific factors
    3. Identify time-frame and monitoring requirements for MNR based on application of technology screen and SMA specific factors
    4. Evaluate effectiveness of overall SMA remedy at reducing risk through residual risk assessment including time-frame for reducing risk
    5. Evaluate need for institutional controls

7) Detailed Evaluation of Remedial Action Alternatives on Site-Wide Basis (Section 6 of RI/FS Guidance):
    a. Identify a range of Site-Wide Remedial Action Alternatives
        i. Apply results of alternative screening step on a SMA by SMA basis
        ii. Consider a range of alternatives such as dredging emphasis, capping emphasis and MNR emphasis for each SMA
        iii. Develop no-action alternative
    b. Evaluate overall protection of human health and the environment
    c. Evaluate compliance with ARARs
    d. Evaluate Long-Term Effectiveness considering:
        i. Effectiveness and schedule for source control efforts
        ii. Recontamination potential analysis
        iii. Effectiveness of monitored natural recovery to reduce contaminant concentrations over time
        iv. Long-term reliability and stability of sediment caps

v. Time-frame to achieve protective levels

e. Reduction of toxicity, mobility and volume through treatment
    i. Application of in-situ and/or ex-situ treatment technologies
f. Short-term effectiveness considering
    i. The potential for releases during dredging and capping activities
    ii. The effectiveness of containment technologies such as silt curtains and sheet piling
    iii. Duration of remedial activities
    iv. Time until protection is achieved
g. Implementability
    i. Flood rise
    ii. Availability and capacity of disposal sites
    iii. Compatibility with existing and likely future land use including site redevelopment, river use, habitat areas and potential restoration sites
    iv. Prioritization and sequencing
    v. Performance measures and monitoring
h. Cost
    i. Capital costs
    ii. Operation and maintenance and monitoring costs
    iii. Mitigation costs